On the transmssion of bat diseases by the media - a view from the trenches

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ABSTRACT

Do scientists maintain a public silence over major issues for fear of the media? I argue that the threat is more apparent than real, and while the relationship can be stressful, scientists and journalists have much in common in searching for the truth. TV treatment of complex scientific topics is generally unsatisfactory, being far too brief. In the print media, the text usually gives an accurate and responsible treatment of what is provided by the scientists, but accompanying headlines frequently do not - often they are sensational, inaccurate and, most likely, all that the public remembers. Ultimately it is the scientists, medical professionals, etc., who are responsible for what appears in the media, and it is essential for them to give appropriate, accurate information, and back-ground briefing. Journalists are prepared to work material over to get it right. Novel findings, which have not been through the process of scientific peer review, should be presented with appropriate qualifications and reservations; hypothesis should not be presented as fact. I give a background of flying-fox biology by which to judge three cautionary case histories of press treatment of public health issues involving the transmission, or possibility of transmission, of serious viral diseases by these large bats. Such issues require informed public discussion. It is the joint responsibility of science/medical professionals and journalists to ensure that such discussion occurs.

Key words: Australian Bat Lyssavirus, Bat Paramyxovirus, Equine Morbillivirus, Flying-foxes, Hendra Virus, Lyssaviruses, Rabies, Ross River Virus.

Introduction

As a biologist I have long been concerned that so few of us make public comment on important issues which fall within our fields of expertise - particularly on the many environmental issues that affect the future. All too many of us keep our heads well below the parapet. Under a ***Courier Mail headline, 13-9-97, "CALL FOR PROBE OF "THREATS" TO GREENS"*** (Figure 1), a report by ***Brendan O'Malley*** stated that, **"A CIVIL liberties group has called for a police investigation into alleged threats against Port Hinchinbrook protesters...**[a developer] **denied he had incited violence...** [a developer] **also warned James Cook University dugong researcher Tony Preen that he would be sued unless he withdrew allegations that Port Hinchinbrook would harm sea-grass beds and dugongs. 'I will serve a writ on Monday if he does not give me an all-out apology for the comments he has made...',** [a developer] **said".**

Fear of being sued is often given as a reason for not speaking out but, to my knowledge, I was the only scientist sued over the Port Hinchinbrook issue, and not for scientific comment but for alleged defamation in a 1994 letter, from which the following is taken, **"in my experience, over the last 15 years, most Australian biologists remain frighteningly silent on major conservation issues. It is a silence of the lambs, because our ever-diminishing areas of natural beauty and wilderness have thereby continued to be cannibalized by a nibble here, a nibble there....... Why the silence? Fear of misquotation, quotation out of context or trivialisation by the media? Yes that happened to me on the 7.30 Report. Fear of ridicule by one's scientific peers - for aligning oneself with a perceived "lunatic fringe".... or for making pronouncements on issues, without "real" scientific evidence? The last is probably the most important, for all of us experienced in scientific research know how difficult and time-consuming it is to obtain real evidence for even one tiny link in an apparent chain of causality. Thus we hate to commit ourselves and often appear to hedge when confronted by aggressive yes-or-no type TV questioning: *a recent 7.30 report with virologists questioned on race-horse deaths is a fine example*"** [my italics].

I do believe that a major reason for silence is fear of publicly appearing to compromise one's scientific integrity because of misrepresentation by the media: trivialisation, factual errors, misquotation, quotation out of context, over-simplication and over-sensational headlines.

Because of my involvement with the public issues of flying-foxes and viral disease issues over 1995-6 I became acutely aware of such concerns with media reporting of science. I also experienced unwanted publicity and some "hounding" by the press and can confirm how very stressful that can be. So, all in all, I started preparing this paper with very negative feelings about the media.

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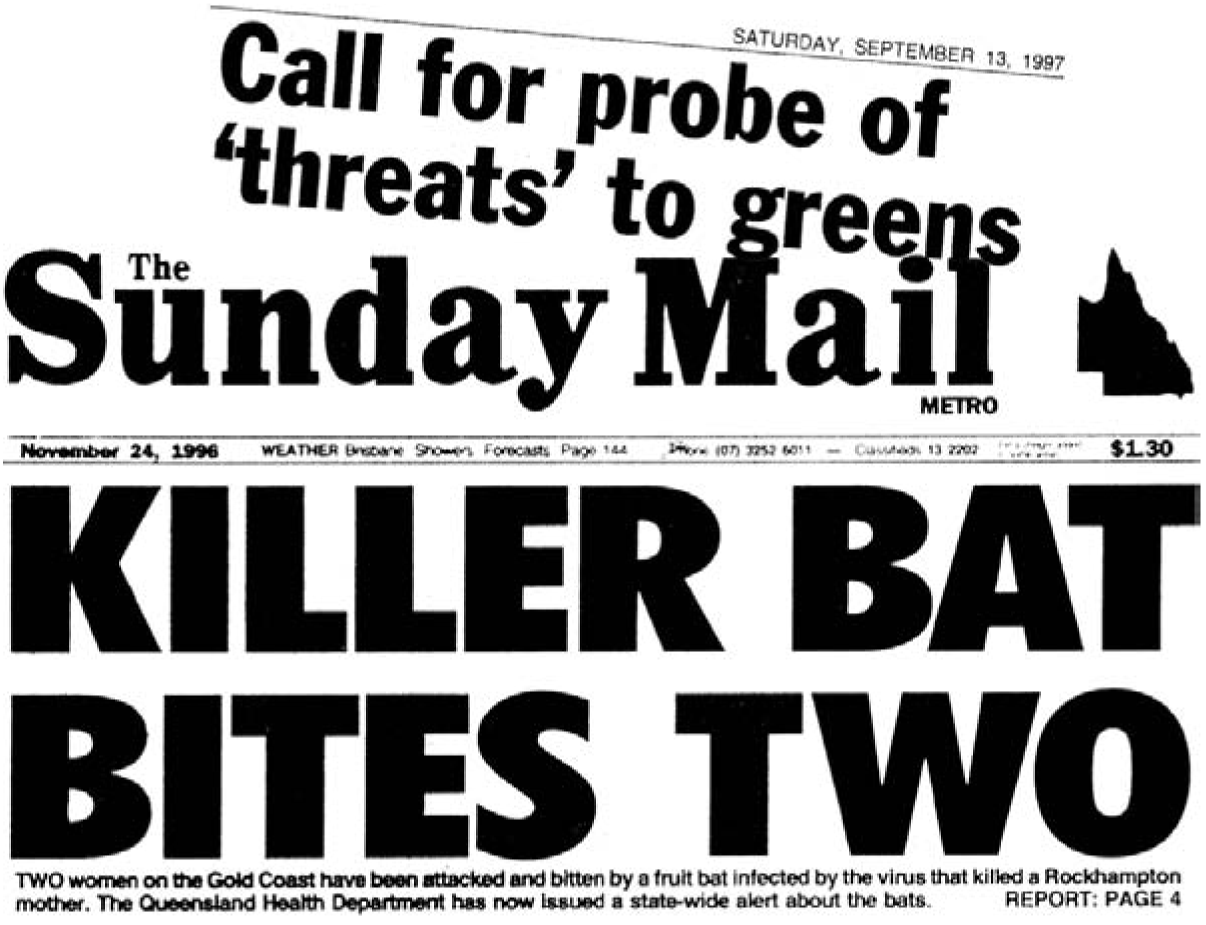


SATURDAY, SEPTEMBER 13, 1997

Call for probe of 'threats' to greens

The Sunday Mail

METRO

November 24, 1996 WEATHER Brisbane Showers Forecasts Page 144 Phone (07) 3252 6011 — Classifieds 13 2202 $1.30

KILLER BAT BITES TWO

TWO women on the Gold Coast have been attacked and bitten by a fruit bat infected by the virus that killed a Rockhampton mother. The Queensland Health Department has now issued a state-wide alert about the bats. REPORT: PAGE 4

Figure 1. Eye-catching headlines.

I found myself contrasting media reportage of scientific findings very unfavourably against "real" publication in reputable, peer-reviewed (refereed) scientific journals with their expert editorial input - a labour intensive and time consuming process when done properly. In particular, a major problem with reportage by the media in Australia is their need for "instant information" and the associated tendency for oversimplification - a particularly serious failing for biological issues, which are usually very complex.

Over-simplification seems worst with Australian TV because of the very short time-slots allowed. But, in what follows, I shall restrict discussion largely to the print media. Why? TV is ephemeral, often little more than colour-and-movement, and very slippery to summarise. In contrast, print offers hard copy evidence and the precision of the written word. However, even when the text is excellent, there can be oversimplication by sensational headline, which is likely to be all that the public remembers, eg. ***frontpage headline, The Sunday Mail, 24-11-96, "KILLER BAT BITES TWO"*** (Figure 1): ***above a picture of US President and Mrs Clinton at Port Douglas, Queensland.***

In fairness we should note that the media do have to cater for an audience whose members may have little scientific knowledge, a short attention span and even low literacy and numeracy skills.

One TV program which does satisfy my criteria for adequacy of presentation is the US Public Broadcasting "News Hour With Jim Lehrer" which can be seen week-nights in Australia on SBS (Special Broadcasting Services). All issues, including complex biological ones, are treated at length. Presentations involve one or more "experts" aided by a resident "presenter", who acts as a mediator when there are multiple sides to an issue, and as a facilitator for the audience, intervening rapidly and with grace to elicit an explanation when an expert is unclear or lapses into jargon. It was on this program that a US journalist made the point that: **"the function of a free press is to bring information to the public so that the public can make a free choice"**

This criterion remained in my mind as I shuffled the huge pile of bat-virus press cuttings accumulated over the previous 24 months - and my overall jaundiced view of journalism and journalists started to change. Sensationalist headlines and a few bits of bad reporting apart, most reportage was of high quality and accuracy.

Many "problems" in reportage stemmed from how scientists presented information in the first place - and I coined a pejorative "publication by press release" to describe the process of premature release, as established fact, of preliminary scientific findings that had not been published in a scientific journal, or gone through any peer-review process. Indeed, I was driven to verse on the issue.

Ode on Hearing of the First "Killer Bat" of Spring
Or
Publication by Press-release
(A Questionable Damned Practice Indeed)
Personal
Perceptions
Predicate that
Persons, who
Publish
Prematurely by
Press-release, may be
P**ded on
Publicly, and
Properly, should be
P**ped on
Perpetually, by
Posterity

With one exception, my views had been presented fairly and accurately in the press. ABC radio interviews enabled me to state my position at length and unedited, and one Brisbane ABC news-compiler went to great lengths to ensure that wording of each 30 sec sound bite was precisely as I wanted it.

In shuffling the press-cuttings it also became clear that:

THE TRUTH WILL OUT IN THE END

This made me realise that science and journalism have much in common. Scientific advance requires ideas, hypotheses, plus experiments to test them. But it also depends on perennial scepticism and detailed, reasoned criticism to expose the crap and fine-hone "The Truth" - and so too does journalism.

Background

"Why does a writer take a particular stance? What axe does the writer have to grind?" Such were my thoughts when reading the texts quoted in the "case histories" of the present article. I have, therefore, attempted to provide readers with sufficient background information for them to make an informed judgement on the issues which follow, and my attitudes to them.

1. The writer. Trained as a zoologist/ecologist at the University of Sydney in the fifties, subsequently researched sex hormone action in the female reproductive tract of laboratory rodents, first at the University of Sydney, then at the Imperial Cancer Research Fund, London, UK. On return to Australia in 1981 started to research sex-hormone action in female flying-foxes and shortly found myself with the world's largest captive breeding colonies, liaising with, and championing, flying-fox carer groups, deeply involved in flying-fox conservation and, when the first virus issue broke, inaugural President of the Australasian Bat Society. I admit to a deep love of flying-foxes.

As a long-time experimentalist I am aware of the difficulty of extracting information from Mother Nature, of the need for rigour, intellectual precision and honesty in obtaining data in the first place, whether by experiment or by sampling, and of the same needs when interpreting that data. As a writer of numerous papers published in reputable scientific journals, a frequent referee for such journals and recent chair of a journal editorial board, I firmly support the need for critical peer review of all scientific publications including this one; [there were two independent referees for this paper, *eds*] and for rigour and intellectual precision in writing. I am also aware that the whole body of "established scientific knowledge" is perpetually open to critical review and subject to change without notice. Indeed, without such continuing critical review, science would not progress.

2. The animals. Flying-foxes (genus *Pteropus*) are large blossom/fruit-feeding bats found only in southeast Asia, India, Australia, the Indian and west Pacific Oceans. They are long lived, gregarious, seasonal breeders with a complex social behaviour. They roost together in large camps which can be noisy and smelly, and are often close to human habitation. They are true bats (Order Chiroptera) but are quite distinct from the small, largely predatory bats (suborder Microchiroptera - "little bats") and are placed in a separate suborder Megachiroptera - "big bats". It is thought that they may have evolved separately to the Microchiroptera, possibly from primates (Pettigrew, Jamieson, Robson, Hall, McNally and Cooper, 1989), and differ from the microchiroptera in many ways (e.g. large eyes; no sophisticated sonar). Flying-foxes sporadically damage crops but in undisturbed habitat, Australian species feed mainly on native blossom and are viewed as important pollinators of hardwood trees as well as seed dispersers. Nevertheless, they are regarded by some as verminous pests and have long been persecuted. There is much public misinformation about their biology.

Many overseas species of *Pteropus* are endangered or extinct because of forest clearing/ hunting. Of some 65 species, the International Union for the Conservation of Nature and Natural Resources (IUCN, 1988) lists some 25% at serious risk. Since females produce 1 young per annum, populations are slow to recover from natural or human-made disasters. In Australia, continuing clearing of scrub/ forest puts the bats at risk, and forces them to alternative food, e.g. commercial fruit. Indeed there is concern that Australian species may be endangered. So, flying-foxes are seen as a major conservation issue by bat-lovers world-wide.

3. Flying-foxes, human contacts and disease before 1996. In Australia, there has been a long history of contacts between humans and flying-foxes with no evidence of transmission of serious disease from the bats before 1996.

Flying-foxes have been in contact with indigenous people since the Dreamtime. A recent survey (Vardon *et al. 1997*) suggests that many thousands of flying-foxes are eaten annually by indigenous peoples in the Northern Territory. Flying-foxes have been in contact with Europeans and their domestic animals since the First Fleet. The bats have mouthed commercial and domestic fruit (saliva) and shed urine and faeces upon fruit, paddocks with domestic animals, and dams and roofs supplying drinking water. Very large camps with tens or hundreds of thousands of flying-foxes are located close to human habitation in the Northern Territory and throughout the east coast of Australia: camps are present in Melbourne and Sydney Botanic Gardens, suburban Sydney and many country towns. Currently there are at least six suburban Brisbane camps. In the 1920/30s there was a bounty on flying-foxes and hundreds of thousands were shot; Ratcliffe (1931) quotes 300,000 being shot over two years in Moreton shire alone. Many of these animals would have been wounded and likely to have soiled, bitten or scratched shooters.

Numerous researchers, including Ratcliffe himself, have regularly entered flying-fox camps and been sprayed with urine and faeces. Most have handled the bats, often without gloves (for manual dexterity) and are frequently scratched, bitten, and exposed to urine and faeces and aerosols thereof. C Tidemann (personal communication, 1996) with various volunteer teams totalling well over 100, has captured, weighed, banded and handled over 5000 flying-foxes across eastern Australia and the Northern Territory over the last decade. M Vardon (personal communication, 1996) and a team of 15 have handled over 400 flying-foxes in the Northern Territory; Vardon quotes C Palmer's team of 5-6 as handling several hundred. J Nelson (personal communication, 1996) handled hundreds of flying-foxes over 30 years. L Hall (personal communication, 1996) over 20 years, handled hundreds of flying-foxes in camps through Queensland, the Northern Territory and the Torres Strait, as has his colleague G Richards. In 15 years I have entered many flying-fox camps in southeast Queensland, with colleagues, visitors, research students and assistants. Around Brisbane, power-line workers regularly handled dead or stunned flying-foxes, often mothers with live new-born young attached.

Members of flying-fox-carer groups routinely dealt at home with injured adult flying-foxes, and newborn young from dead or injured mothers, the bats coming into contact with other family members, domestic pets and visitors. Handling injured adult flying-foxes exposed carers to bites, scratches, urine and faeces. Adult flying-foxes, too crippled for release, were often retained as demonstration animals.

Carers' families had prolonged, intimate contact with orphan flying-foxes: exposure to urine, faeces, sebum, bites, scratches and regular licks on the lips, even kissing. Carers made contact with residual birth fluids on umbilical-cord newborn flying-foxes. Carers frequently had pet dogs and cats in proximity to flying-foxes; many had orphan marsupials at the same time; some had horses. Orphan Native Animals Rear and Release (ONARR) founder Ms H Luckhoff had, for 12 years, an open cage in her suburban back yard, which was regularly visited by hundreds of free-flying flying-foxes throughout each year and became the major release-site of foster-reared flying-foxes. Over this period, numerous pet cats frequented the inside and top of this cage without ill-effect!

Friends of Far North Flying Foxes and others have handled thousands of *P. conspicillatus*. In North Queensland; there are ONARR-style groups in Townsville, Mackay and Rockhampton, which have dealt with some hundreds of flying-foxes. Brisbane ONARR reared and released over 2000 orphans from 1984 to 1996; on average, 50-80 injured adults came in per year, but some years provided hundreds; some 500 carer families have been involved. In New South Wales, carer groups raised 1401 young between 1988 and 1996; 548 sick or injured flying-foxes were handled and treated between 1989 and 1996, with 950 carers and families involved.

From 1983-1996, our outdoor cages at The University of Queensland Veterinary Science farm held up to 300 flying-foxes from three species (*P. poliocephalus, P. alecto, P. scapulatus*). Up to 1996, no special precautions were taken by colleagues, PhD students, research assistants and technicians involved in regular handling, collecting blood, and maintenance, beyond sometimes wearing gloves to minimise injuries from bites. Exposure to urine and faeces was frequent. Personnel on weekend feeding rosters often involved family members in everyday clothing who would have been exposed to urine & faeces, and sebum & saliva from friendly flying-foxes.

Thus, up to 1996 there was no evidence of disease transmission from flying-foxes to indigenous people, carers or domestic pets, to researchers and assistants in the field, or in captive flying-fox colonies. This epidemiological evidence needs to be kept in mind in relation to my response to the case histories below.

Results: three case histories

Suddenly, in 1995-6, three successive public health issues arose, each of major concern. Each involved transmission, or possible transmission, of a serious viral disease by flying-foxes. Each required responsible dissemination of complex information to the public to enable an informed resolution of possibly conflicting needs - public health versus bat conservation. But - these issues involved bats (with the opportunity for endless awful "Batman" jokes) and viruses, both of which could offer fantasy/ science-fiction scenarios to the media, and a treasure trove of scary headlines involving:

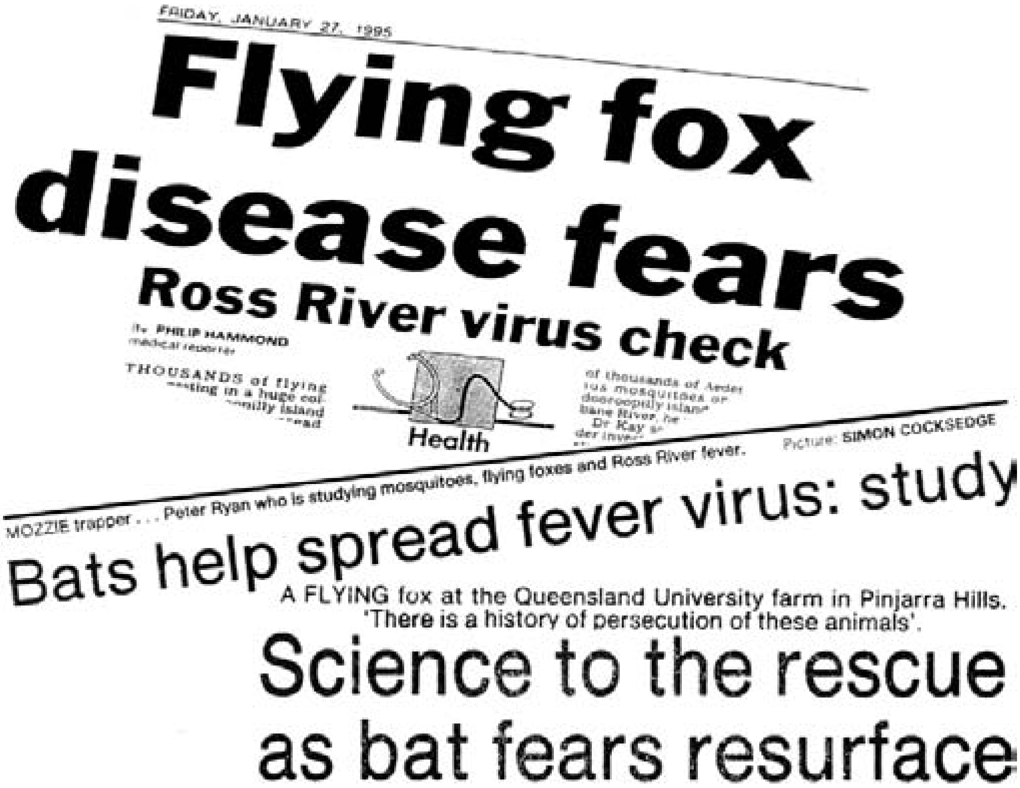
CREATURES OF THE NIGHT, WITCHCRAFT, VAMPIRES, THE OCCULT, SATANISM

PLAGUE, DEATH, TERROR, PANIC, MAD-COW-DISEASE-DISEASE

So, how did we fare?

Case-history 1. Hypothesis to headline - flying-foxes and Ross River Fever

In January 1995 an angry Brisbane flying-fox carer contacted me: she had received anonymous threats of physical violence because of her backyard flying-foxes. The threats arose from a ***Courier Mail Headline 27-1-1995*** (Figure 2) ***"FLYING FOX DISEASE FEARS, ROSS RIVER VIRUS CHECK".*** An article by ***medical reporter Philip Hammond,*** stated that,**"THOUSANDS of flying foxes nesting in a huge colony on Indooroopilly island could be helping spread Ross River fever over the Brisbane region... flying foxes can have antibodies... to Ross River virus".**



FRIDAY, JANUARY 27, 1995

Flying fox disease fears

Ross River virus check

By PHILIP HAMMOND
medical reporter

THOUSANDS of flying

Picture: SIMON COCKSEDGE

MOZZIE trapper . . . Peter Ryan who is studying mosquitoes, flying foxes and Ross River fever.

Bats help spread fever virus: study

A FLYING fox at the Queensland University farm in Pinjarra Hills.
'There is a history of persecution of these animals'.

Science to the rescue as bat fears resurface

Figure 2 Headlines dealing with Ross River Virus in flying-foxes.

The text explained that workers at the Queensland Institute of Medical Research had found that many species of mosquitoes around Brisbane were capable of transmitting Ross River Virus (RRV). There were reports from elsewhere of antibodies to RRV being found in flying foxes. Large numbers of mosquitoes bred at Indooroopilly Island underneath the flying foxes, *ergo* the mosquitoes could infect the flying foxes, the flying foxes could then fly around Brisbane, be bitten by other mosquitoes, which could in turn bite humans, and thus the bats would spread RRV far and wide. Panic among some members of the public.

A similar result from a ***Courier Mail headline 30-11-1995*** (Figure 2) ***"BATS HELP SPREAD FEVER VIRUS: STUDY"*** and report by ***medical reporter Philip Hammond*** stating that **"THOUSANDS of flying foxes winging across Brisbane... could be helping to spread Ross River fever, a study has revealed... a potential for swamp mosquitoes living below the bats' Indooroopilly Island camp to infect the mammals... 'We concluded that the... Island appears to be a source of potential vectors which may be involved in the transmission of... Ross River Fever...', Mr Ryan said...When tens of thousands of bats roosted in trees and... mosquito populations peaked, the flying foxes 'may be involved to a low level' in circulating the virus, he said".** Note that the scientist (an Honours student) had included all the appropriate qualifications and the journalist had faithfully reproduced them, yet, in the headline, hypothesis became fact, although there was no experimental verification of the hypothesis.

What both reports failed to mention was that many mammals had shown a high frequency of antibodies against RRV: horses, cows, dogs, rats, mice, kangaroos, wallabies, possums - and presumably microbats - RRV is not species specific. Indeed, researchers first produced an experimental infection of RRV from the blood of kangaroos, and marsupials are thought to be an important reservoir of the virus in the wild. There is also a very high incidence of antibodies to RRV in humans in Queensland: overall incidence 31.6% rising with increasing age to 51.9% in those over 70 (Phillips *et al.* 1990).

The reports also did not explain the significance of the presence of antibodies in relation to an animal being infective - or to having developed clinical symptoms of the disease - clearly most antibody-positive humans do not! The presence of antibodies simply indicates that an animal has been exposed to RRV and has mounted an immune response against it. Infection requires a relatively large number of RRV particles to be injected into the blood (usually by a mosquito) - one particle is not enough. If the infection takes, the virus multiplies in the new host and, after an incubation period of several days, numerous virus particles appear in the blood of the host. The presence of virus particles in the blood is termed "viraemia". It is in this phase that the host is infective in that it can pass on the RRV to further mosquitoes. Again, infection of the mosquitoes requires the passage of a relatively large number of virus particles. The host's viraemia is transient. After a few days the number of virus particles in the blood falls to undetectable levels and the host becomes essentially non-infective. It is in the later stages of the viraemia that the level of antibodies against the virus rises.

I wrote in the Australasian Bat Society newsletter at the time (Martin 1995), **"before we start panicking about flying foxes carrying RRV, we need to determine: if the mosquitoes breeding in the water actually bite the flying foxes hanging in the trees; if the flying foxes develop viraemia... if they do, do they then fly out to feed; if they do, do they feed in situations where they will be bitten by mosquito species capable of transmitting RRV. In the meantime what about all those other friendly neighbourhood species living in and around our homes who might be carriers? Particularly all those other Humans? I joke not. One expert with whom I discussed the matter maintains that there was no need to postulate animal reservoirs - the frequency of the disease in the human population was more than enough to keep it going".**

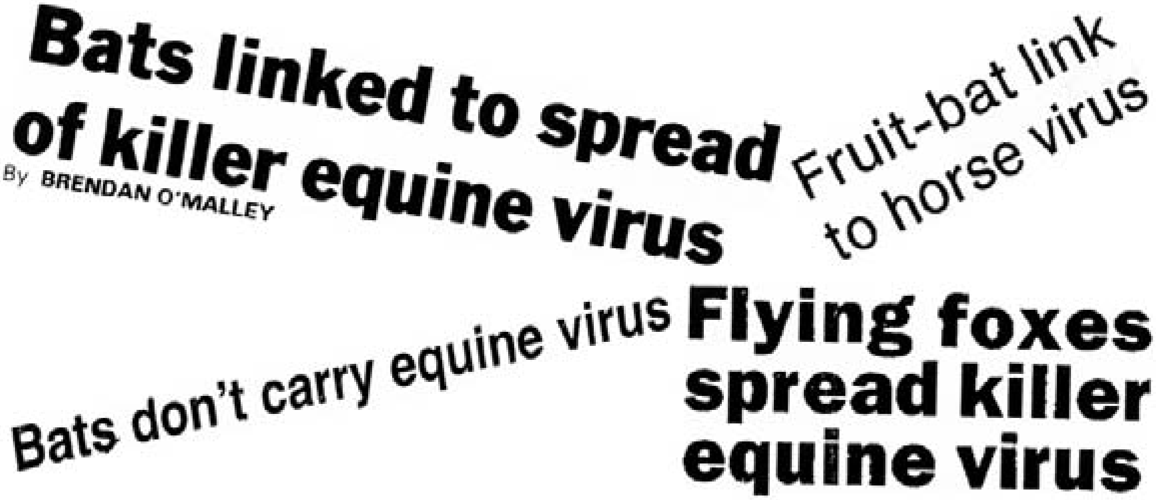
Early in this little saga, under a ***Courier Mail* headline 7-2-1995, *"SCIENCE TO THE RESCUE AS BAT FEARS RESURFACE"*** (Figure 2) a report ***without byline,*** stated that **"Dr Martin yesterday tested out the Ross river virus transmission hypothesis using young fruit bats... Dr Brian Kay is trying to better understand the activity of mosquitoes... 'That flying foxes might spread Ross River virus is a working hypothesis'...Dr Martin said the joint project... would... see to what extent bats could be infected with Ross River virus from mosquitoes... if the bats developed viraemia... at what level and for how long".** As you see, the headline jumps the gun, while the text also leaves something to be desired. Yes, I became involved with the Queensland Institute of Medical Research in experimentally infecting some of my captive grey-headed flying-foxes with RRV, but it was not a quick answer - just getting the ethics and biohazard approvals took months. Yes, some flying-foxes did develop a transient, low level viraemia, but the conclusion was that they are poor vertebrate hosts of RRV compared with other mammals and marsupials (Ryan *et al.* 1997).

Antibodies play a large role in the next case history - the story of Equine Morbillivirus (EMV) and the Bat Paramyxovirus (BPV) of flying foxes, both now known as Hendra virus.

Case-history 2. Publication by press-release: a question of identity

Equine Morbillivirus is the virus which killed race horses and two men in 1994/5, and virus isolates were shown to also kill cats and guinea pigs (Westbury *et al.* 1995). At the time that flying-foxes became involved, part of the genome of this isolate had been sequenced. This genomic analysis **"demonstrated a closer relationship of EMV with the morbillivirus genera... than other members of the Paramyxoviridae (paramyxoviruses and pneumoviruses). The relationship is distant since... EMV is less than 50% homologous with the other morbilliviruses... placement of EMV may be more consistent as a separate genus within the Paramyxoviridae"** (Gould 1996).

Once a virus is isolated, it can be used to screen animals for naturally occurring antibodies which recognise the virus and bind to it - such antibodies indicate that the animal has been infected by that virus *- or one similar to it*. Once naturally occurring antibodies are detected they can be tested to determine if they neutralise or kill the virus: if they do, this is strong evidence that the naturally occurring virus which generated the antibody is closely related, if not identical, to the disease-causing virus. Such techniques were the basis for a ***Queensland Department of Primary Industry (QDPI) Press release, 10-5-1996,*** headlined, ***"DPI SCIENTISTS CLOSER TO SOLVING VIRUS PUZZLE",*** and which linked flying-foxes to EMV, stating that, **"discovery that some flying foxes... have been infected with a similar virus... flying foxes were the only animal species, other than the seven horses involved in the initial outbreak, to have recorded antibodies that reacted to EMV...DPI scientists in collaboration... would continue their work to determine whether this newly detected flying fox paramyxovirus and equine morbillivirus were similar or the same... there was still a long way to go to determine the origin of EMV".**


Bats linked to spread of killer equine virus

By BRENDAN O'MALLEY

Fruit-bat link to horse virus

Bats don't carry equine virus

Flying foxes spread killer equine virus

Figure 3 Headlines following the discovery, in flying foxes, of antibodies cross-reacting with Equine morbillivirus (now known as Hendra virus).

No scientist could quibble with that wording, it was spot on, and contained all necessary caveats. Nevertheless, while a small ***Courier Mail*** report by ***Michael Madigan (13-5-96)*** was appropriately headlined, ***"FRUIT-BAT LINK TO HORSE VIRUS"***, (Figure 3) the release generated the ***Rockhampton Newspaper 12-5-1996 headline*** (Figure 3), ***"FLYING FOXES SPREAD EQUINE KILLER VIRUS"***, **"BRISBANE - Some flying fox species harbour a virus similar to the one which killed... 14 race horses two years ago, The Queensland Government said yesterday"**, even though the text (without byline) reproduced much of the press release verbatim.

It was also of concern to receive a University of Queensland memo dated 17-5-1996 which, by an error, converted "high titres of antibody" to "high titres of virus" long before the bat virus had been isolated," ***RE: PRECAUTIONS FOR HANDLING FLYING FOXES - POSSIBLE EQUINE MORBILLIVIRUS INFECTION*** **Joint work by staff at the University of Queensland and Department of Primary Industries to determine the native host(s) of Equine Morbillivirus has shown reasonably high titre level in 11 out of 55 flying foxes".** By omitting, "of antibodies", after "titre level" the wrong information was given though, a later section stated, **"While it is not certain that the antibodies found in flying foxes can be directly attributable to EMV it would be prudent to institute safe handling practices as soon as possible... EMV has been listed...as a category IV pathogens"** (*sic*).

As the memo was accompanied by a letter from CSIRO's Australian Animal Health Laboratory detailing the stringent isolation procedures required for handling infected animals, it was perhaps not surprising that one antibody-positive flying-fox (not mine) was immediately euthanased. Remember that, at this stage, all that had been detected in flying-foxes were antibodies which recognised EMV. Indeed antibody tests on stored blood samples had shown that the unknown virus had been present in my captive colonies since at least 1990.

Because of alarmist reporting of the Queensland Department of Primary Industry press release and the concerns of flying-fox-carers and researchers, the executive of the Australasian Bat Society prepared a carefully worded press release (scrutinised and approved by University of Queensland Microbiology Professor J S Mackenzie), naming Greg Richards and myself as contact persons. ***Australasian Bat Society press release, 27-5-1996, "NO EVIDENCE OF TRANSMISSION OF SERIOUS DISEASE FROM FLYING-FOXES TO HUMANS.*** **There has been much alarmist reporting since the announcement by the Queensland Department of Primary Industry of the detection, in flying foxes, of antibodies which recognise the equine morbillivirus (EMV). It is important to note that: EMV itself has not been isolated from flying foxes; the antibodies detected may reflect infection by a related virus; for the past decade and a half, many hundreds of people in Queensland and NSW have, each year, handled and raised wild orphan and crippled flying foxes; amongst this large human population in direct, prolonged and intimate contact with flying-foxes, there have been no reports of serious disease attributable to the bats. Thus there is no evidence of the transmission of serious disease from flying-foxes to humans. Indeed, the epidemiological data, based on many thousands of human-bat contact hours, show that, if there has been a morbilli-like virus circulating within the flying-fox population, it has posed little or no risk to humans".**

Alas, despite all our care with the wording, it generated the following awful headline (Figure 3) and text stating that Dr Len Martin had cleared flying-foxes of ever carrying any virus: ***Fraser Coast Chronicle headline, 14-6-1996,*** (Figure 3) ***"BATS DON'T CARRY EQUINE VIRUS" and text without byline,*** **"Flying foxes have been cleared of carrying equine morbillivirus (EMV) just months after being similarly cleared of carrying Ross River fever. Vice-president of the Australasian Bat Society Dr Len Martin said... Recently Dr Martin also dispelled notions of flying foxes carrying Ross River fever and other viruses, saying it had never been proved that flying foxes were capable of acting as host carriers of viruses".** I wrote to complain, but had no reply, saw no retraction.

Once a virus has been isolated, antibodies against it can be generated in laboratory animals. These antibodies can be linked to a dye and the resultant reagent used to screen for the virus (or its close relatives) in suspect animals. This was how Queensland Department of Primary Industry virologists first detected, in flying foxes, the virus initially referred to as bat paramyxovirus (BPV). Detection was followed by isolation of virus, examination by electron microscopy, sequencing of a small part of the viral genome and a ***QDPI press release 16-10-1996, headline "BREAKTHROUGH IN SEARCH FOR VIRUS"***. Although the release stated that, **"the finding did not mean that flying foxes present a significant risk to people... is likely the virus has been in flying fox populations for a very long time without generally causing problems"**, it began with, **"identification of the flying fox as the natural host of the *virus*** [my underlining]**... equine morbillivirus has been associated with the death of two people and a number of horses"**, and continued, **"Researchers had now isolated a virus from... flying foxes... had shown this... bat paramyxovirus to be identical** [my underlining] **to the equine morbillivirus... We now firmly believe this disease is primarily a disease of flying foxes"** [my underlining].

The question of complete identity of BPV with EMV was emphasised by DPI personnel in media interviews: eg., **"That's right we've now... isolated a bat paramyxovirus... and have been able to demonstrate... that bat paramyxovirus is one and the same as the equine morbillivirus".**

Brendan O'Malley in ***The Courier Mail, 17-10-96*** quoted the press release correctly, along with fears expressed by flying-fox carers, headlining it very reasonably as ***"BATS LINKED TO SPREAD OF KILLER VIRUS"*** (Figure 3).

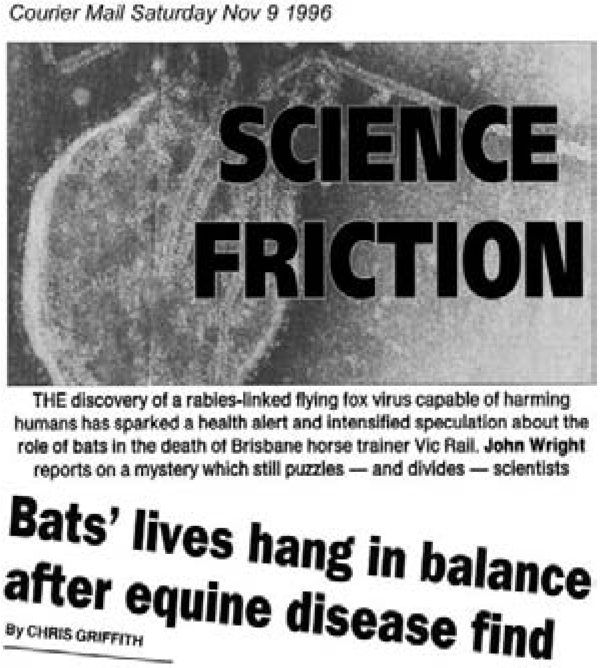
As you can imagine, the claims of "identity" and "disease of flying foxes" were very disturbing to the many carers who had had flying-foxes within the bosoms of their families for many years without any evidence of any EMV-like disease in their flying-foxes or their pets, let alone humans. My phone rang hot and one very astute, experienced, and highly indignant carer emailed me: **"it cannot be stated that they are "one and the same"...If these two viruses are the same then how is it possible that from 16 infected horses two people died. However, from thousands of flying foxes handled by thousands of carers not one single human has been infected. The answer has to be, they are not the same....That the DPI are... unable to verify conclusively that EMV is in fact a morbillivirus supports that testing... is incomplete and therefore any comparison must be considered incomplete... It was stated to me...that the reason one of the horse trainers died was due to the type of exposure... exposing him to saliva containing the virus...Therefore thousands of carers daily kissing their flying foxes, tongues up the nose in the mouth, is not considered by the DPI as comparable exposure. My personal thoughts are the DPI have been grossly irresponsible in their reporting of their findings".**

I too was concerned at the way the findings were released because of: fall-out on flying-fox carers; possible grave effects on flying-fox conservation; possible termination of my flying-fox colony and research thereon; possible inadequate scientific evidence for use of the term "identical". Because of my long-time involvement with flying-fox research, carer groups, and the Australasian Bat Society executive I had written an article, "Viruses in Australian Flying-foxes" for the October 1996 ABS Newsletter in which I attempted to clarify the findings on RRV, the newly detected flying-fox *Lyssavirus*, and the flying-fox EMV-cross-reacting-antibody (Martin,1996a). Just as the newsletter was going to press, the QDPI press-release on "identical virus" came out and I therefore prepared a four page insert for the ABS newletter "Update on so-called equine morbillivirus in flying-foxes", in which I attempted to critically examine, the evidence for the "identical" claim.

I co-operated with QDPI by supplying flying-fox samples for their research, but got into their bad books by publically questioning their use of the term "identical" maintaining (as I still do) that most biologists and the public would take it to mean that BPV had *exactly the same genome and pathogenicity as* EMV. For example **New Scientist, 26-10-1996**, had a brief mention as: ***"HORSE KILLER FOUND*** **Fruit bats also known as flying foxes are the source of a virus that killed a racehorse trainer and 14 of his Thoroughbreds in Queensland two years ago"**

In discussion with me, one QDPI virologist had admitted that the bat virus might be a different "biotype" (i.e. strain) to the EMV which killed the horses, but pooh-hoohed my assertion that the public would understand the term "identical" to mean that BPV had exactly the same virulence and pathogenicity as EMV, and emphasised that viruses such as EMV "are not clonal". I took this to mean that different isolates of one such virus may differ genetically, while still being the same type (species) of virus. Does this mean that one can claim that two viruses are identical when they are different? The Oxford English Dictionary defines "identical" as, **"The same, the very same: agreeing entirely in material constitution, properties, qualities or meaning"**.

I gave interviews on ABC radio and my reservations were published at length in an excellent long report by ***John Wright, The Courier Mail Saturday 9-11-96, headlined "SCIENCE FRICTION"*** (Figure 4), which reviewed the issue thoroughly and is worth quoting at length: **"Dr Len Martin, 'They have said that the viruses are identical in the sense that their tests, as far as they know, do not show they are different... But the genetic sequencing on EMV now being conducted is not complete. There is no dispute that the bat virus is closely related (to EMV), but the DPI needs to... send some of the isolates down to Geelong and have them tested for virulence... The appropriate tests have not been done and in that respect the DPI has been premature...' Young** [QDPI] **admitted... there was 'a small doubt' that the viruses were identical, but said he was '99 percent sure that it's exactly the same. All the stuff we've done on it so far shows that it is identical. The only doubt is that we have not sequenced the complete genome of the virus and there could be some change in genes where we haven't looked'".**



Courier Mail Saturday Nov 9 1996

SCIENCE FRICTION

THE discovery of a rabies-linked flying fox virus capable of harming humans has sparked a health alert and intensified speculation about the role of bats in the death of Brisbane horse trainer Vic Rail. **John Wright** reports on a mystery which still puzzles — and divides — scientists

Bats' lives hang in balance after equine disease find

By CHRIS GRIFFITH

Figure 4 Stressful headlines relating to the isolation, from flying foxes, of Bat paramyxovirus (now known as Hendra virus).

So, was the controversy simply a question of semantics? I think not. What was the evidence for identity of Bat Paramyxovirus and Equine Morbillivirus in October 1996?

1. Antibodies against authentic Equine Morbillivirus neutralised Bat Paramyxovirus (just as antibodies against Classic Rabies neutralise flying-fox *Lyssavirus*!!)
2. Flying-fox antibodies against Bat Paramyxovirus neutralised Equine Morbillivirus (as antibodies against Cowpox neutralise Smallpox!!).
3. Bat Paramyxovirus and Equine Morbillivirus had the same form when examined by electron microscopy.

4. Examination of a small portion (approximately 200 nucleotides) of viral "matrix-protein" genome from Bat Paramyxovirus showed it to vary by <20% from the corresponding region of authentic Equine Morbillivirus genome (the complete Equine Morbillivirus genome contains over 18,000 nucleotides).

Did the above constitute "proof of identity"? I think not. Even if viruses such as Equine morbillivirus "are not clonal", only a minute portion of the Bat paramyxovirus genome was sequenced, and it is accepted that minute changes in genome can have profound effects on biological properties, including pathogenicity. Thus, the well known sickle cell anaemia, in which human red-blood cells are destroyed prematurely because of their different shape, is due to a single nucleotide change in the genome (GAG□GTG) which leads to a difference of *one* amino-acid in the haemoglobin ß protein. In other words, could we exclude the possibility that Bat Paramyxovirus and Equine Morbillivirus were different strains of the one species of virus with quite different pathogenicities, just as different influenza strains vary in their virulence. To emphasize that it was not just a matter of semantics, I cite a later report (***The Australian* 5-10-98**) about the viral poultry killer, Newcastle disease, which noted that **"many native birds already carry a low-virulent strain"**. Was the Bat Paramyxovirus of native flying-foxes a "low-virulent" strain of Equine Morbillivirus?

I remained concerned that QDPI did not appear to qualify their original assertion of "identity", or raise, publically, the possibility that flying-fox Bat Paramyxovirus could well differ in pathogenicity from authentic Equine Morbillivirus - certainly the press continued to regard them as identical. To my knowledge, at that time, the pathogenicity of the flying-fox Bat Paramyxovirus had not been tested in susceptible animals, and QDPI's research had not been published in a reputable refereed journal. In this context, the wording of the short report in ***Communicable Disease Intelligence* 28-10-1996** by Halpin *et al* (1996) ***"IDENTIFICATION OF LIKELY NATURAL HOSTS FOR EQUINE MORBILLIVIRUS"*** deserves quoting. It stated that flying-fox Bat Paramyxovirus, **"appears to be identical to the equine morbillivirus... isolation of this new virus suggests that flying foxes may be the natural host [of EMV]... Preliminary studies have shown that a part of the genetic sequence... is identical to the corresponding sequence of the EMV isolates. These results indicate that BPV and EMV are likely to be the same virus"** [my underlinings]. I had no quarrel with this wording, only with that of the 16-10-1996 press release.

McColl, *et al.* (1997) described further research at the Australian Animal Health Laboratories, **"the purpose was to... evaluate the degree of similarity between [EMV and BPV]. Clarifying the relationship... is of primary importance...sequenced over 60% of the bat isolate... no significant differences with the EMV horse isolate genome. Likewise, when comparing the proteins... the two appeared identical. These findings continue to support our contention that the virus known as EMV and BPV are one and the same"** [my underlinings]. This article also described the, **"biohazard level 4 facilities, where researchers wear protective "space suits" to grow and purify EMV... needed to characterise both the genome and proteins... [and] recently determined the complete nucleotide sequence of the EMV genome. It's [*sic*] length of over 18,300 nucleotides is staggering, considering that the genome size of all other members of the Paramyxovirus family is only approximately 16,000 nucleotides... comparison of the nucleotide sequence of individual genes indicates that EMV differs significantly from other morbilliviruses... is almost certainly the first representative of a new group of viruses in the Paramyxovirus family. Knowledge of the complete nucleotide sequence of the EMV genome indicates that the name equine morbillivirus is inappropriate, as is the name bat paramyxovirus"**.

Mention of "Biohazard level 4 facilities" highlights a major paradox in this issue. If "Equine Morbillivirus" is a "killer virus" how dangerous is "Bat Paramyxovirus" to humans? On one thing, the QDPI and I have always agreed: that Bat Paramyxovirus is *not* a major health hazard, and QDPI have always emphasised this; e.g. the 10-5-1996 release stated, **"this similar virus in flying foxes is not cause for alarm as far as public health is concerned... this virus has been present in flying fox populations for some time and... these... have been in close contact with people without any evidence of cross infection,.... initial belief of health authorities that the virus if it is the same as EMV, is most difficult to spread and represents a very low risk",** and the 16-10-1996 release, **"This finding does not mean that flying foxes present a significant risk to people, but care should be taken in handling the animals... it is likely that the virus has been been in flying fox populations for a very long time without generally causing problems"**.

This was reinforced by the finding (Selvey *et al* 1996) that none of 128 flying-fox carers who were screened for antibodies against Equine Morbillivirus proved positive, despite their, **"considerable histories of contact with flying foxes... findings suggest that neither prolonged close contact nor casual contact with flying foxes engenders a risk of equine morbillivirus infection in humans"**. Nonetheless, in an age of health and safety concerns, and employers' fear of litigation, the implications of the simple equation

$$BPV=EMV$$

made me deeply concerned for the future of my flying-fox colony. Thus the final quarter of 1996 was highly stressful. The flying-fox *Lyssavirus* story had broken. I was trying to maintain my flying-fox research, deal with media queries and inform/ reassure flying-fox carers about both viruses, and prepare a flying-fox-risk-assessment document for my Head of Department, as well as the Australasian Bat Society. Not unreasonably, my Head of Department, becoming rather tense about the health and safety issues, publicity involving our department, and the antagonism between myself and QDPI, wanted to have things quietened down. Then, on 27-10-96, came a ***Sunday Mail*** article headlined (Figure 4), ***"BATS' LIVES HANG IN BALANCE AFTER EQUINE DISEASE FIND"*** by ***Chris Griffith*** complete with picture of me kissing a flying-fox.

I had discussed concerns about my flying-fox colony with various colleagues: closure due to putative Bat Paramyxovirus health risks; closure due to lack of funding*.

The reporter, sharing accommodation with a colleague's PhD student, picked up on the story from him, first approaching our lab manager who gave some background. My Head of Department was unavailable for comment; I spoke at length on the phone to the reporter, but, in my paranoia of the time, refused to be quoted. The reporter honoured that request, but circumnavigated the hurdle by quoting a colleague as to what I had said to him. When article and picture appeared (the picture dating from many years previously) I was horrified and telephoned my HOD in panic - he was supportive and understanding. I went, mouthing obscene descriptions of said reporter to my friendly neighbourhood, University of Queensland journalist, Ron Drynan, who read the article, thought it was reasonable, and said that the reporter had simply been doing his job. As I reread the article two years later I tend to agree with Ron - but it was extremely painful at the time.

I have gone into detail over the nature of Bat Paramyxovirus and Equine Morbillivirus to illustrate how complex such issues are, and to emphasise how important it is that scientists use precise language when informing the media of their findings, so that the media can most effectively simplify/ transmit the information to the public.

Case-history 4. Flying-fox Lyssavirus: a question of semantics?

This is a much more serious health issue - one which has already had a tragic outcome and one again involving questions of the exact identity of a virus.

Rabies is a *Lyssavirus* and, in 1996, six serotypes (STs) had been recognised within the genus: ST1, Rabies Virus; ST2, Lagos Bat Virus; ST3, Mokolo Virus; ST4, Duvenhage Virus; ST5, European Bat *Lyssavirus* I; ST6, European Bat *Lyssavirus* II. European Bat *Lyssaviruses* are carried by microbats (not megabats) and are related to the African Duvenhage Virus (King *et al* 1994; Schneider and Cox 1994). Serotypes 2-6 are sometimes referred to as "non-rabies *Lyssaviruses*". In the USA, the *Lyssavirus* carried by micro-bats is ST1 (Rabies) however, there are genomic and serological differences between ST1 strains carried by different mammals. Thus bat Rabies is detectably different from raccoon Rabies, which is different from skunk Rabies and so on.

All *Lyssaviruses* cause rabies-like diseases in infected animals, with encephalitis (inflammation of the brain) and death the likely outcome. The usual route of infection of Humans is via bites or scratches from infected animals with virus particles in the saliva. In attempting, as a professional biologist but non-virologist, to explain the implications of Bat Paramyxovirus and *Lyssavirus* to flying-fox carer groups (Martin 1996a and b), I drew the ire of some professional virologists because of how I treated the subject - not always conforming to current dogma. As far as possible I attempted to confirm things with a virologist before committing to print - but not always successfully - I know just how journalists feel!

The *Lyssavirus* of Australian flying-foxes is a new serotype (ST7) distinct from Rabies but closely related, in that it has a genome base-homology of approximately 79% and a protein amino-acid homology of approximately 92%. Also, antibodies against Rabies can neutralise and protect against flying-fox *Lyssavirus* ST7, whereas such antibodies are only partially effective, or ineffective, in neutralising the other, so-called "non-rabies *Lyssavirus*" STs.

The story broke in mid-1996. During the survey of flying-foxes for Bat Paramyxovirus, some were found to be infected with a *Lyssavirus*. It was detected using antibodies against Rabies. Response was prompt, with non-alarmist press releases. Thus in June, the ***NSW Minister for Agriculture*** announced that a **"Lyssavirus which is related to the rabies virus was discovered in a Black Flying Fox from... Northern NSW... While the discovery of the Lyssavirus poses little or very low risk to human health** [my underlining]**, people... ought to take extra precautions to ensure they aren't bitten... it is likely that the Lyssavirus has been present in Australian bat populations for millennia without causing any problems to human or animal health... the bat... was... exhibiting mild nervous disorders... Lyssavirus is common in bat populations in Europe... at this stage it isn't known if it is precisely the same virus... there have been no unusual illnesses or deaths reported in bat colonies and it should be remembered these bats are a protected species... people who live near bat colonies are not at risk... Mr Amery said Australia's rabies-free status has not been altered... and urged the media to be balanced in its reporting..."**

Press reports were generally appropriate, but a ***"WARNING OVER 'RABIES' VIRUS IN FRUIT BATS"*** headline, was followed by, **"A RABIES-like virus responsible for deaths in Europe has been detected in a flying fox in the north of the state... The virus is common in fruit bats in Europe, where human deaths are said to occasionally occur from bites.....** [the *lyssavirus*] **spreads readily through fruit bat colonies due to their frequent scratching and rubbing of each other"**. Where did this "information" come from? There are no fruit bats in Europe!!

In July, a brief but very useful report, ***"HUMAN HEALTH ASPECTS OF A POSSIBLE Lyssavirus IN A BLACK FLYING FOX"*** (Crerar *et al.* 1996) summarised the biology of the *Lyssaviruses* and suggested that, **"The**

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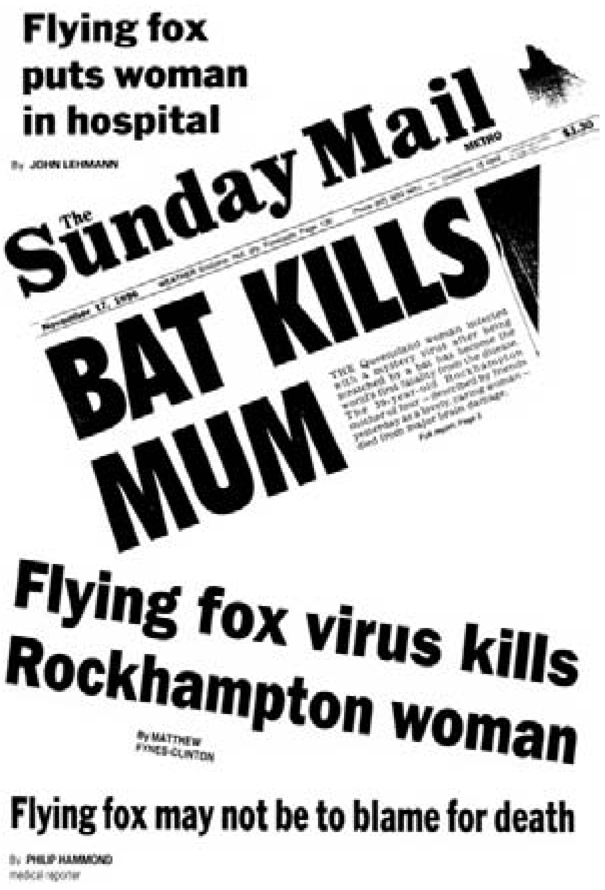
*The colony and its infra-structure had been built up over many years of Australian Research Council-funded research, which was ending 12 months after my retirement at the end of 1995. I could see the colony serving as a major facility for future Bat Paramyxovirus /*Lyssavirus* research. Closure would be a disaster. In the event, the colony survived. My remaining flying-foxes went to QDPI who, at the time I wrote this article, continued to use the facilities we had built up, and the colony supplied animals to the Australian Animal Health Laboratory.



Flying fox puts woman in hospital

By JOHN LEHMANN

The Sunday Mail

BAT KILLS MUM

Flying fox virus kills Rockhampton woman

By MATTHEW FYNES-CLINTON

Flying fox may not be to blame for death

By PHILIP HAMMOND
medical reporter

Figure 5 Headlines relating to the infection and death of an animal carer from Lyssavirus.

extremely low health risk posed by rabies-like *lyssaviruses* combined with the probable isolated nature of this incident in Australia indicates there is not a need to change current public health advice... there is no indication for specific *lyssavirus* treatment in people bitten or scratched by flying foxes... The exception would be if the flying fox... was known to be infected with a *lyssavirus*... It is unclear... whether *lyssaviruses* are endemic in Australian flying fox colonies, although it is considered unlikely." [my underlinings]. It is not clear why this article took the opposite view to the June press release as to the likelihood of *Lyssavirus* being endemic in Australian flying foxes.

By September 1996 *Lyssavirus* isolated from the flying-fox of the June press release, was characterised as being a distinct new serotype - ST7. Autopsy brain samples from another northern-NSW juvenile black flying-fox, which had shown behavioural abnormalities and bitten a carer in March 1995, were *Lyssavirus* ST7-positive. A Townsville *P. scapulatus* showing signs of neurological disease had tested positive, as had a black flying-fox from SE Queensland. So there were almost a half dozen cases from wide-spread locations. A small report in ***The Courier Mail (5-9-96)***, headlined, ***"FLYING FOX SCARE"***, stated that, **"Health authorities have warned people to avoid flying foxes after the discovery of a rare, rabies like virus... should avoid being bitten because of the potential risk of contracting lyssavirus".**

In discussing *Lyssavirus* with carers, it was clear to me that there had always been a small proportion of bats coming into care with neurological problems, notably paralysis of the hind legs, a condition previously attributed to lead-poisoning or spinal injury - but the syndrome may well have been due to *Lyssavirus*. The Townsville *P. scapulatus* had paralysed hind-legs. I emphasised (Martin 1996a), that we didn't know what the probability was of *Lyssavirus* infecting humans, but if infection occurred, the subsequent disease could be nasty and life threatening, **"What to do? Be aware - take care. If bitten, wash the wound immediately. If the biter was showing behavioural or movement abnormalities indicative of neurological problems then it should go straight off to the vet to be euthanased and tested for LV. Meanwhile, assuming that the newly detected LV is not a recent exotic import, I reiterate the ABS statement about EMV: *Among a large human population in direct, prolonged and intimate contact with flying-foxes, there have been no reports of serious disease attributable to the bats. Thus there is no evidence of transmission of serious disease from flying-foxes to humans. Indeed, the epidemiological data, based on many thousands of human-bat contact hours, show that any LV circulating within flying-fox populations poses little or no risk to humans.* Nonetheless, there is some risk - very small perhaps, but finite, ie. real. For a long time we have enjoyed the disease-free state of Australian bats, and being able to demonstrate the animals freely to the public - allow them to be handled etc. Alas, all flying fox carers and bat handlers must to [*sic*] look long and carefully at how they present their beloved animals to the public in the light of EMV and OZBLV"** [Australian Bat *Lyssavirus*].

On ***7-11-1996, QDPI*** issued a ***LYSSAVIRUS UPDATE 2 INFORMATION SHEET FOR VETERINARIANS,*** which was circulated to flying-fox carers, as was a press release of the same date from ***Queensland Minister of Health, Mike Horan***, ***"QUEENSLAND HEALTH WARNS FLYING FOX HANDLERS OF NEW VIRUS"***, **"The warning follows the first case of transmission of the virus in Australia to an animal handler... who had cared for injured flying foxes... is in a serious condition in Royal Brisbane Hospital... Queensland Health Chief Health Officer, Dr Diana Lange, said, while the virus was related to the rabies virus, the lyssavirus clearly was not rabies but a quite distinct new type of virus."** A brief ***Courier Mail*** report ***by John Lehmann, 8-11-96,*** headlined ***"FLYING FOX PUTS WOMAN INTO HOSPITAL"*** (Figure 5) gave an accurate summary of the situation.

The voluntary flying-fox carer groups had played a major but, at that time, largely unsung role in providing flying-foxes for Bat Paramyxovius and subsequently *Lyssavirus* research. They had been, and continue to be, front-line troops in Australia's wildlife disease surveillance network. It was tragic therefore that, after decades of disease-free association between flying-foxes and carer groups, a Rockhampton flying-fox carer should be infected with *Lyssavirus* and die on 15-11-1996, as reported by ***The Sunday Mail 17-11-96 frontpage headline,*** (Figure 5) ***"BAT KILLS MUM" and page 2 title,*** (Figure 5) ***"FLYING FOX VIRUS KILLS ROCKHAMPTON***

WOMAN", with an excellent article by ***Matthew Fynes-Clinton*** which discussed the nature of the disease, its public health implications, precautions which should be taken, and the protection afforded by Rabies vaccine.

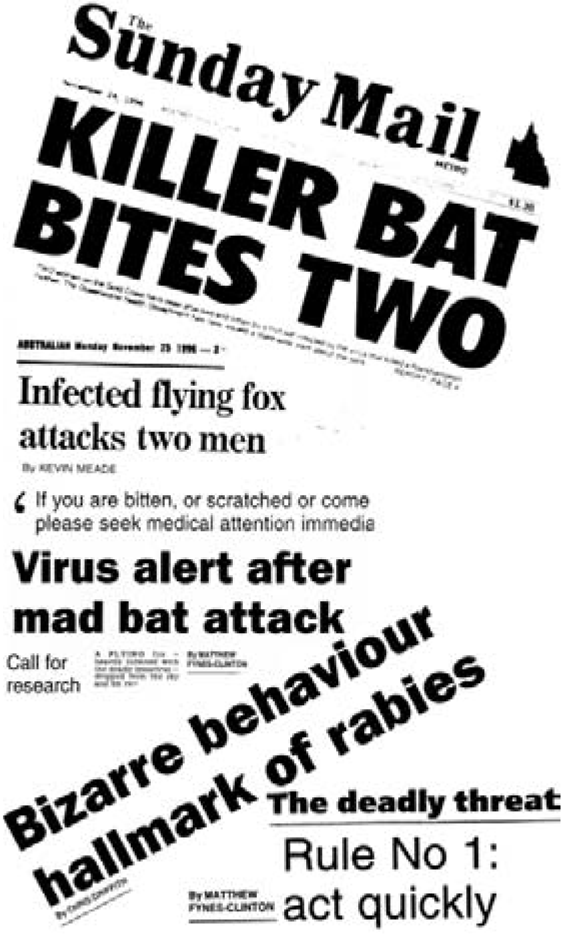
Unfortunately, a second article in the same issue, headlined ***"KILLER BAT DISEASE A NEW VIRUS STRAIN"***, by ***Chris Griffith and Sid Maher***, stated that, **"the much maligned flying fox, or fruit bat, is responsible for speading many different strains of lyssavirus... can fly long distances while harbouring the virus in its salivary glands without any fatal infection to itself. It is not surprising that flying foxes have been detected as carriers of other lethal viruses such as equine morbillivirus..."** I would classify that as "worst case" journalism, as was the adjacent headline ***"DEADLY VIRUS NO THREAT***"to a segment (without byline) which quoted Helen Luckhoff of Brisbane Orphan Native Animals Rear and Release at length about the precautions she would take when handling flying-foxes, including, **"We are dealing with something that if you get it will probably kill you if you don't have immediate treatment... at the same time I think it is something that will be pretty hard to catch"**. Irresponsible headlining?

Odd how incorrect information gets promulgated, thus, in an otherwise excellent article in ***The Australian 13-11-96,*** headlined ***VIRUS SPREADS ITS WINGS***, ***Leisa Scott*** wrote, **"the head of the Australian National Centre for Disease Control and chair of a national taskforce into the new virus... warns there is no room for complacency. Indeed, in Europe, one person dies every three years from a virus that fruit bats transmit by bites".** It just isn't true!

Over the period of the carer's sickness and death there were many items in the press about *Lyssavirus*, precautions to be taken etc., e.g.: ***The Australian 9-11-96 "SCIENTISTS SEEK URGENT VACCINE FOR FLYING FOX VIRUS***" and ***12-11-96 "BAT VIRUS TASK FORCE SEEKS NATIONAL VACCCINATION ALERT"***; ***The Courier Mail 12-11-96***, ***"NATIONAL ACTION ON BAT VIRUS"*** and ***23-11-96, "TRAGIC LOVE"*** & ***"DARK SIDE TO AN UNLIKELY VILLAIN"***; ***The Sun Herald 17-11-96 frontpage, "KILLER VIRUS CRISIS***". Without exception, the accompanying texts were accurate, informative and responsible.

Those of us in the flying-fox network knew that the carer who died had been bitten and scratched by various animals, including a flying-fox, a possum and a microbat - all of which had been disposed of well before she fell sick, and so were unavailable for *Lyssavirus* testing. Moreover, the carer had had a very bad reaction to the microbat bite - a Yellow-bellied Sheathtail bat (*Taphozous flaviventris*, recently renamed *Saccilaimus flaviventris*). Although various of us raised the question that this animal might be the source of *Lyssavirus* e.g. ***The Courier Mail 30-11-96 "FLYING FOX MAY NOT BE TO BLAME FOR DEATH"*** (Figure 5) quoting Dr Les Hall's reservations, at the time, the authorities were not interested - obviously the *Lyssavirus* ST7 came from a flying-fox. Later, a small sample of Yellow-bellied Sheathtail bats from Queensland proved to have a high frequency of *Lyssavirus* ST7 infection (4/5!). Nonetheless, until recently, it was assumed that the carer had been infected with *Lyssavirus* ST7 by a flying-fox.

The Sunday Mail 24-11-1996, published a huge front page headline ***"KILLER BAT BITES TWO"*** (Figure 6) above a picture of the Clintons in Port Douglas. A ***page 2 article by Matthew Fynes-Clinton***, headlined, ***"VIRUS ALERT AFTER MAD BAT ATTACK"*** (Figure 6) gave precise details, **"A FLYING FOX - heavily infected with the deadly lyssavirus - dropped from the sky and bit two women on the Gold Coast two weeks ago... 'The behaviour of this flying fox does seem strange', Health Minister Mike Horan said. 'The veterinary report...was that it seemed to have undergone some sort of personality change'. The women were from the Gold Coast and Sydney. After a smear of brain tissue from the flying fox came back positive on Friday afternoon the Gold Coast Woman was located in Brisbane and inoculated with a rabies vaccine... Late Friday, senior health officer John Scott delivered a briefing paper to State Director-General of Health... The brief told how the two women were walking... when the flying fox fell from the sky or a tree, landing on one of their heads. As the flying fox began to bite the woman, her friend tried to wrench it off and was also attacked. It is believed both women were bitten and scratched. The extent of their injuries is unclear , although the first victim did get bitten on the scalp".** ***P.47*** had an article by ***Chris Griffith***, appropriately headlined ***"BIZARRE BEHAVIOUR HALLMARK OF RABIES***", (Figure 6) which gave a brief, accurate account



The Sunday Mail

KILLER BAT BITES TWO

Infected flying fox attacks two men

By KEVIN MEADE

' If you are bitten, or scratched or come please seek medical attention immedia

Virus alert after mad bat attack

Call for research

Bizarre behaviour hallmark of rabies

The deadly threat

Rule No 1: act quickly

By MATTHEW FYNES-CLINTON

Figure 6 Headlines arising from the accidental biting of two men by a carer-reared, Lyssavirus-free, orphan flying fox.

of rabies, its effects in humans and other animals including microbats in the US, and distinguishing between mega- and micro-bats. Alongside, an article by ***Mathew Fynes-Clinton, headlined "THE DEADLY THREAT RULE No 1: ACT QUICKLY".*** usefully emphasised, the very real danger presented by *Lyssavirus* and the very real need for anyone bitten or scratched by a bat to seek medical attention immediately. So, despite certain comic aspects discussed below, the reporting brought important information to the public.

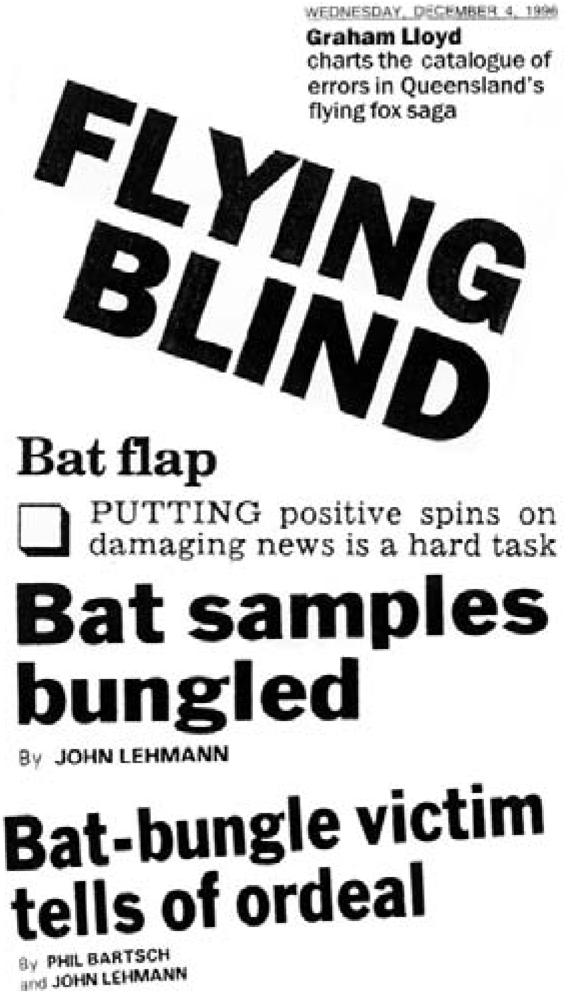
The Australian 25-11-1996 carried a small headline *"INFECTED FLYING FOX ATTACKS TWO MEN"* (Figure 6). Aside from the change in gender, the report tallied with that in ***The Sunday Mail***, but worse was to come: the flying-fox was an orphan pet having trouble adjusting to the wild and landed in the woman's hair; the flying-fox was not infected with *Lyssavirus* - the sample had been mixed up during testing! The last became public knowledge with consecutive articles in ***The Courier Mail 28/29-11-1996,*** not inappropriately headlined *"BAT SAMPLES BUNGLED"*, *"BAT-BUNGLE VICTIM TELLS OF ORDEAL"* (Figure 7). ***The Sunday Mail 1-12-1996***, in a small tongue-in-cheek report titled *"BAT FLAP"* (Figure 7), with cartoon, commented that, **"PUTTING positive spins on damaging news is a hard task... not even the very best of spin doctors could have wriggled their way out of the predicament... The tactic employed... was to issue a cheery news release headed 'Currumbin Bat Cleared of Lyssavirus'. It quoted the minister as greatly relieved that the two victims scratched were not at risk. However, the DPI was no longer confident enough to refer to the victims as either 'men' or 'women', just 'people'. It is unclear whether the animal will sue for defamation".**

Full details were later given in an excellent article in ***The Courier Mail 4-12-96,*** nicely headlined *"FLYING BLIND"* (Figure 7), with a picture of a flying-fox right way up) and subtitled *"GRAHAM LLOYD CHARTS THE CATALOGUE OF ERRORS IN QUEENSLAND'S FLYING FOX SAGA"* - **"The scenario was of demented, rabies-infected bats dropping from the sky to attack... high drama turned to farce... for instance the two women reportedly attacked... turned out to be two men. The bat which reportedly had dropped from the sky to attack was not a rabid, demented creature, but a hand-reared orphan having problems adapting to the wild. It had not descended to attack but had landed on the head of a... woman at a... barbecue. An interstate visitor dragged it from the woman's head, and in the process had been bitten. The party host, John Lovett, also was bitten... But it wasn't only the gender of the alleged rabid bat victims that was to become mixed up... after samples from the bat had been sent to CSIRO's Australian Animal Health Laboratory... Lovett was informed the bat bite had exposed him to a potentially deadly virus. Within three hours of the bat testing positive... Lovett was injected with a course of rabies vaccinations... The only problem was that the tests had been performed on the wrong bat".**

To repeat, *THE TRUTH WILL OUT IN THE END*.

An epilogue

Many months later, complete with full page colour headline ***"PLAGUES UPON US"*** and sub-headlines ***"VIRAL THREAT CLOSES IN"*** and ***"THE NIGHTMARE CATALOGUE"*** an article in ***The Sunday Mail 13-7-97*** by ***Stephen Lamble*** reported **"Head of Queensland Department of Primary Industries' virus research group, Dr Peter Young... said it was now known that transmission [of EMV] from bats to horses was an extremely rare event and there was *strong evidence* flying foxes were the reservoir host... Unlike EMV, which was first transmitted from bats to horses and then to humans, lyssa virus requires no intermediate host... Russell Rogers, principal veterinary officer... at the DPI animal health laboratories... said it now seemed possible Mrs Padget** [the Rockhampton carer who died] **was not infected by a flying fox as first thought but by an insect-eating yellow-bellied sheath-tailed bat... Dr Young said... more work had to be done because there was a slight difference in strains of lyssa virus identified in fruit bats and yellow-bellied sheath-tailed bats. 'It is possible one of them is more virulent than the other', *he said.*"** [my underlining]



WEDNESDAY, DECEMBER 4, 1996

Graham Lloyd
charts the catalogue of errors in Queensland's flying fox saga

FLYING BLIND

Bat flap

☐ PUTTING positive spins on damaging news is a hard task

Bat samples bungled

By JOHN LEHMANN

Bat-bungle victim tells of ordeal

By PHIL BARTSCH and JOHN LEHMANN

Figure 7 The truth will out: later headlines relating to those illustrated in Figure 6.

Thus the article floated the idea that humans could not catch Equine morbillivirus from flying-foxes, but could from horses after they caught it from flying-foxes. It also suggested that late pregnant flying-foxes might present the greatest risk to humans, **"Researchers... hope blood and tissue samples collected from pregnant... flying foxes in August, September and October will contain traces of *the deadly virus*... Russell Rogers said EMV was isolated in five different species of fruit bats between August and October last year and it might be these months were the only times when humans and horses were at risk**".

As all flying-fox carers know from decades of experience, these are the months when carers and their families have had greatest exposure to flying-foxes - birth fluids and all. Bat Paramyxovirus was present in my flying-fox colonies back at least to 1990: one old antibody positive female, which later expressed the virus, had undergone surgery and been repeatedly handled for blood sampling over many years. Interestingly, the aborted but apparently healthy twin *P. poliocephalus* foetuses illustrated in Martin (1998) are those from which Bat Paramyxovirus was first isolated, and part of its genome sequenced. The mother had aborted after becoming entangled and seriously injured in razor-wire (she had to be euthanased). It should be noted that late pregnant flying-foxes abort when stressed or starved (Dukelow *et al.* 1990; Hall *et al.* 1991), and that abortion *per se* is not necessarily indicative of disease or infection with Bat Paramyxovirus. After collecting the twin foetuses from the carer, I photgraphed and dissected them, before passing the remnants to QDPI. I am negative for antibodies which cross-react with Equine Morbillivirus.

As I was finishing writing the present paper in October 1998, it became public knowledge that it was *Lyssavirus* ST7 from a Yellow-bellied Sheathtail bat, not a flying-fox, which killed the Rockhampton carer; emphasising again that the truth will out!

Conclusion and discussion

Overall, the press fulfilled their function by bringing accurate information to "the public", and enabled "the public" to make informed judgements. There were one or two minor lapses in accuracy by journalists, but some "problems" in presentation derived from the way the primary sources provided information. However, in most cases, the truth did out in the end! Unfortunately, while the fine print was generally spot on, the big headlines often weren't - and, let's face it, it is the headlines that people tend to remember.

MAD BAT ATTACK - FLYING FOXES SPREAD KILLER VIRUS

That is probably my major beef. The bad news is that many people remain very confused about Equine morbillivirus and *Lyssavirus* - which is which, and which does what - much in the way many people confuse greenhouse warming and the hole in the ozone layer. They are familiar with the words but not with their meaning. The good news is that there does not seem to have been the mass slaughter of flying-foxes that many of us feared when these various stories broke.

Perhaps more serious, I believe that there has been a failure to adequately warn the public about the possible danger from *Lyssavirus* ST7 in microbats, and indeed of the possibility of its spill-over into other mammals. I do not believe that that is the media's fault. I can understand that the authorities, not wishing to generate unnecessary public alarm, are tending to keep quiet on the issue for fear of compromising "Australia's rabies free status". Nevertheless, I have heard some cautionary tales about veterinarians, medical practitioners and carers that suggest the message has not got through of just how real the threat from *Lyssavirus* ST7 could be - so, to stimulate ongoing discussion, I'll try my own sensationalist headlines.

AUSTRALIAN BAT LYSSAVIRUS, A RABIES-LIKE KILLER

WILL IT SPREAD TO OTHER AUSTRALIAN MAMMALS?

My worry of messages not getting through was reinforced by reading, as I began this final section, Sydney journalist, Jennifer Cooke's superb account of Creutzfeldt-Jakob disease and Australia's involvement (Cooke 1998) - a cautionary tale indeed of the need for the bureaucracy, health authorities, medical professionals and scientists to keep the general public (that's you and me, don't forget) - fully informed. To be "fully informed" is not just to be aware of "the facts" but also to be aware of the questions and *caveats*. So, in the next section I raise some - alas, probably all a bit too complex for a press release but we'll try: ***Len Martin's Press Release,***

CONCERNS ABOUT THE FUTURE OF AUSTRALIAN BAT LYSSAVIRUS.

The tendency throughout the *Lyssavirus* saga has been to regard a flying-fox as a bat is a bat is a bat: that one bat is very much like another. Also, on the basis of experience in Europe, where there appears to be no transfer of microbat *Lyssavirus* into terrestrial mammals such as foxes (Schneider and Cox, 1994), it has been assumed that the same limitation will apply here. Perhaps so, but there remains another worry, spillover of *Lyssavirus* into other species. In view of the high frequency with which Australian flying-foxes come into human care, one can envisage just as many downed, rabid flying-foxes coming into contact with (i.e. biting and scratching) foxes, wild and domestic cats and dogs, dingoes and that robust domestic scavenger, the brushtailed possum. Even if the *Lyssavirus* ST7 strain cannot establish itself in such species, there is, surely, the likelihood of occasional spill-over into individual animals, which would then pose a danger to humans. Flying-fox carers and researchers are now routinely treated with rabies vaccine. Are veterinarians and carers of other wildlife? If not, why not?

Lyssavirus (ST7) has already been found in the Yellow-bellied Sheathtail bat and McColl *et al.* (1997) stated that it had been found in, "5 unidentified insectivorous bats" in Australia. Microbats are evolutionarily separate from flying-foxes. To give some idea of how much, cats and dogs, belong to separate mammalian families in the order, Carnivora. Yellow-bellied Sheathtail bats and flying-foxes are not just in separate families, but in different suborders of the order Chiroptera. Aside from both being nocturnal fliers, there is no great ecological or physiological connection between Yellow-bellied Sheathtail bats and flying-foxes. Six other sheathtail microbat species are found in Australia, plus some 40 other microbats in five different families, and including genera (*Eptesicus* [now *Vespadelus*] and *Myotis*) in which *Lyssavirus* is found in Europe and rabies in the USA.

In the USA, rabies *Lyssavirus* ST1 strains found in different mammalian species have detectable differences in genomic and antigenic constitution. It remains unclear if such differences are crucial to the maintenance of a particular rabies strain in a particular mammalian species, or how rabies spreads from one mammal species to become established in another. In Australia, the *Lyssavirus* found in Yellow-bellied Sheathtail bats is a member of the same serotype as that of flying-foxes (ST7) yet detectably different. *Lyssavirus* ST7 has been found in all 4 species of Australian flying-fox (family Pteropodidae). There are four Australian small megabat species in four other genera in this family; are they more or less likely to be carrying *Lyssavirus* ST7 than microbats?

How long has *Lyssavirus* ST7 been in Australia? The public health authority consensus appears to be "a long time", and the existence of distinct *Lyssavirus* "strains" in mega and microbats tends to support this view. However, did the microbats catch it from the megabats or vice versa? It is possible that one or both *Lyssavirus* ST7 strains were present in islands to the north of Australia and only recently entered. I favour recent entry largely because there was no case of *Lyssavirus* or other rabies-like sickness in humans before 1996. Despite the high incidence of *Lyssavirus* in flying-fox populations at that time, and the huge exposure of humans to flying-fox bites and scratches in the decades beforehand; the first death from *Lyssavirus* came within months of *Lyssavirus* ST7 being detected.

Helen Luckhoff, founder of ONARR, one of Australia's largest and most respected carers' groups, and with vast expertise in flying-fox biology and care, favours the "for millenia" scenario. She counters my "human epidemiology case" with two arguments. Firstly, most carers are experienced/ highly competent in handling flying-foxes, particularly when flying-foxes first come into care: Helen cites the following data: since January 1998, ~300 sick or injured flying-foxes have been collected by ONARR carers in southeast Queensland; more than 13 of these animals were *Lyssavirus* ST7 positive; no ONARR carers were bitten - though several members of the general public were. Helen also argues that, while *Lyssavirus* ST7 is very closely related to rabies, infective passage to humans may be rare because the "window" of flying-fox infectiousness is narrow ie. *Lyssavirus* ST7 may only be present in saliva for a short time. Such limited salivary expression of virus would probably be determined by the physiology of the flying-fox rather than the viral genome. Only further research will tell.

Another argument for the "for millennia" scenario is the wide geographic distribution of *Lyssavirus* ST7. This was raised at a Brisbane briefing of carers and researchers in 1996. I pointed out then that it was a weak argument because Little Red flying-fox populations undertook annual seasonal migrations spanning North Queensland to Victoria. However, there is an aspect of rabies which could reconcile the "for millennia" and "human epidemiology" scenarios. It is well known that rabies can be absent from wild animal populations for long periods, presumably simmering away in some remote spot, then, for reasons still unknown, the disease suddenly takes-off and spreads through the population. Many of the above issues are discussed at length in an excellent paper on the health and conservation implications of Australian bat *Lyssavirus* by Tidemann *et al.* (1997).

Recommendations

Whatever the final outcome to these questions, I believe that the more the public is informed, and the more informed public discussion there is, the better-off we, the public, will be. In that respect, scientists and others should have more confidence in dealing with journalists. In particular they should be much more explicit - I reiterate - "A pox on publication by press release". I found journalists prepared to work material over so as to get it right, and where we had done that together, the final result was very satisfactory. In respect of some of the mis-information that was published, one wonders if the journalists' "sources of information" were to blame. If there is a take-home message it is "For good communication it is necessary to communicate properly - with goodwill on both sides". Better still, "Make friends with a journalist" - I know I have.

Acknowledgements

Greatest thanks must go to my business manager and literary advisor, Kay for unfailing support through difficult times and without whom this manuscript would never have been completed. Thanks also to: the ARC for supporting my research for many years - research without which I would not have found myself in this... position; my scientific and carer colleagues for valuable discussion and comment, in particular Helen Luckhoff; the editor and referees, whose comments greatly improved the paper; the *Courier Mail, Sunday Mail* and *Australian,* for permission to reproduce material published by them. Finally, a thankyou to all of the journalists involved - writing this paper has been a salutary experience and given me a bit more feeling for what your job is like.

POST-SCRIPT, OCTOBER 1999

To my knowledge, there has still been no pathological infection by Bat paramyxovirus/ Equine Morbillivirus (both now called Hendra virus) of humans consorting with flying foxes. Flying-fox blood samples collected by us back to 1982 have recently been shown by QDPI to have antibodies against Hendra virus, indicating that the virus was present in my captive colonies from the very beginning. The mechanisms of flying-fox-to-horse infection remain a puzzle.

There has been a second Australian death from *Lyssavirus* ST7 with evidence confirming that infection was this time via flying fox and with the flying-fox strain.

Since completing this paper I have not closely followed press treatment of Australian bat virus issues and cannot, therefore, comment on its quality. To those wishing to bring themselves up to date on viruses in flying foxes, I highly recommend an excellent recent review by Field and Ross (1999) which covers most of the issues discussed above, plus the Menangle and Nipah viruses. An earlier paper by St. George (1989) gives a stimulating discussion of the physiology and ecology of lyssavirsus disease transmission, and the role of bats.

The symposium paper was presented in October 1997, twelve months after the hectic events of 1996. The longer written version was prepared in October 1998. So, was I, even then, too critical of how QDPI presented their results? I leave the reader to judge. There is no doubt as to the scientific merit of QDPI's research on Hendra virus, and I was privileged to be invited to their recent colloquium on the virus, for which I offer my thanks.

In ***The Weekend Australian* 16/17-10-99, *Science and Technology, David Tanner*** reported statements by chief of CSIRO's plant industry division, James Peacock on genetically modified (GM) food, notably: "Dr Peacock says the scientific community has only itself to blame for the public uproar over GM foods and organisms. 'There hasn't been enough information about the new technologies available in a way that can be understood by the consumer,' he says".

Maybe so, but the process is not easy, as the present article demonstrates.

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BRONWYN WOOD: I'm a bat, megabat and microbat, carer and it's more an amplification on something Len said, his comment about scientists needing to be much more precise about what they give to the media. I don't think we can entirely blame the media for some of the hysteria that has been generated. I have been concerned about the feeling that has been generated by things that have been written by scientists and by carers in scientific journals, in papers, and in interdisciplinary welfare newsletters and the Australasian Bat Society. The feeling that came across very strongly to me from what scientists and some carers were writing was that "These filthy disease-ridden animals we know, we're apologising, we know they're a threat to human life and property but hey, they're ecologically necessary so we have to put up with them."

I really feel that that is a negative attitude, for which we can't blame the media because it has actually come from us. I was bitten by a yellow-bellied sheath-tailed bat 3 or 4 years ago and I'm not running around thinking I'm getting a lyssavirus. What concerns me is that it's a rare animal in some areas of Australia and apart from putting down things like flying foxes every time one bites or scratches, we're putting down rare animals every time one bites or scratches. I have been bitten and scratched by hundreds of mega and microbats and it concerns me greatly. They bite and scratch for a lot of reasons, not just because they have the lyssavirus. Really, I think we need to be a bit more friendly to them ourselves before we start accusing the media of being unfriendly.

LEN MARTIN: I think those comments stand alone. I don't really strongly disagree with anything you have said. I will amplify one point. I think it is important that those of us who are concerned with the conservation of these animals don't go too far on the conservation side and say, "Forget about the disease."

I attended a community meeting in Maclean earlier this year where there is a flying-fox camp in remnant rainforest right beside the school. Without wishing to offend the conservationists who were there - and I count myself as a fairly rabid conservationist - there was that tendency to say, "Move the school rather than the bats." There was a tendency not to let the parents get up and have their say and I went out of my way to make sure that the parents had their say and one of the kids got up and said, "These bats are flying all over us."

I emphasised that we could not afford to ignore the lyssavirus issue in this. We don't know what the probability is of this particular virus getting into humans, how easy it is for humans to catch the disease from the bats, whether the bats carry it for a long or a short time in their saliva. It's a big "don't know" area, so we have to adopt the precautionary principle of taking care. I fear that this may well involve having to euthanase animals. I know how many carers get upset by this.

MIKE ARCHER: Len, I'm very curious about your remark about "a pox on press releases." Our experience over the last 20 years in desperately trying to communicate coherent stories to media groups - apart from brilliant people like Bob Beale here - has been fairly disappointing in the same way that you have had disappointments. The best successes we have had are when we have actually given them something written. There's always the risk that they will misconstrue that or deliberately embellish it in their own language but it's the safest path we have found to make sure that they get the right story in the first place - - -

LEN MARTIN: Yes, I would agree.

MIKE ARCHER: - - - particularly with spelling which is one of the other atrocious problems.

LEN MARTIN: Yes, I agree. I suppose I was reacting emotionally to a certain press release - the DPI one that I felt was inappropriate, and hadn't used the appropriate wording. Interestingly enough, one of the virologists involved in the research complained - I have a copy of his letter, he faxed it to me because we ended up somewhat at loggerheads, but he actually faxed a copy of a letter he had written to the government department saying, "I wish you had consulted me about the press release before you sent it out. I'm getting all this flak." So I had that particular one in mind.

I agree with you that the properly designed and appropriately worded press release is a good thing, but this was almost publication by press release. I suppose the other one that we can think of is the press release about the Aboriginal paintings, the ageing of the Aboriginal paintings, which went out as a press release before it had gone to a refereed journal. I know that you can argue that with a disease issue - there is perhaps some reason for urgency - but I don't think either of us would disagree that if we do use a press release it has to be very, very carefully worded and it's still an efficient method.

ALLEN GREER (Australian Museum): Len, I just want to make two comments in defence of the text writers. It's my understanding that that text can be heavily edited by a subeditor.

LEN MARTIN: Yes, yes.

ALLEN GREER: Perhaps even more importantly, the headline writer is somebody totally different and I think they cause as much despair amongst the writers as they do amongst the scientists.

LEN MARTIN: Agreed.

ALLEN GREER: So perhaps we need to concentrate on the headline writers, but they're out to sell a different message.

LEN MARTIN: I think we do. Most of the text, apart from one or two examples, was very good.

POSTSCRIPT JANUARY 2003

Nothing has changed significantly since 1999 regarding *Lyssa,* Hendra and Menangle viruses in flying-foxes (FFs). Field (2002) concludes that, **"It is probable that all have existed in Australian flying-foxes historically, rather than being recent introductions. Infection with Hendra virus and Menangle virus is common in Grey-headed Flying-foxes (and others): Australian bat lyssavirus** [ABL] **infection is rare in wild-caught Grey-headed Flying-foxes (and others), but more common in sick and injured individuals. While there is no evidence that Hendra or Menangle virus infections are transmitted directly from flying-foxes to humans, it is clear that direct contact with an ABL-infected flying-fox presents a serious human health risk from a saliva-contaminated bite, scratch or mucous membrane. Fruit is not regarded as a mode of transmission...".** This article confirmed that the first human death from ABL came via a micro-bat, *Saccolaimus flaviventris* - a fact that has never received the publicity due to it. Recently, Hume Field (personal communication 2002) indicated that ABL has now been detected in some half dozen Australian microbat species. To my knowledge this information remains unpublicised, yet there are frequent media references to FFs and disease.

Among Australian native mammals, FFs appear to be unique in the extent to which they engender hostility in human communities; hostility so intense as to border on paranoia - and this was true before the detection of these diseases! Such hostility can lead to illegal "vigilante" actions:- disturbance of camps, slaughter of animals. Increasingly, the diseases are being used as an excuse for forcible removal of roosting FFs. Media comments frequently inflame the situation. Thus the QLD *Sunday Mail 25/8/02*, captioned a picture of FFs in a tree, **"DRIVEN BATTY: Charters Towers residents avoid disease-spreadinq flying foxes".** Sometimes the media promulgate misinformation:- **"A Northern Territory scientist ... says bat faeces can spread the potentially fatal lyssavirus..."** *ABC News, 21/9/02***.** Faeces do not spread the lyssavirus, ie. that information is incorrect. (A check was made, and the scientist said that the information given to the media was that many people don't like bats - they can consume commercial fruits, they can defaecate on houses, cars and washing, and they can be vectors for unpleasant diseases – and the interviewer was then referred to the Health Dept to get information on lyssavirus. Obviously the translation of this message to what the ABC wrote in their story was wrong. It seems the ABC simply ran the defaecating and the disease into a cause-effect.) To counteract such misinformation, state health authorities should, in conjunction with the Australasian Bat Society, prepare an authoritative account of the health issues of these diseases, which can be used as a media-release as required. In this respect I was very impresssed by the **Joint Press Release** by the [Uk] *Department Of Health and DEFRA (http://www.defra.gov.uk) 28/9/02.* **"SUSPECTED CASE OF BAT RABIES IN LANCASHIRE Initial tests carried out on a Daubenton's bat... have shown positive results for a strain of rabies. Confirmatory tests are in progress...".** The **Notes for Editors** which followed were even more impressive: "**If the confirmatory tests... prove positive, the likely agent will be European Bat Lyssavirus (EBL), a strain of rabies common in bats across Northern Europe... EBL rabies will not affect the UK's rabies-free status. EBLs are closely related to classical rabies virus. They have been known to infect not only the primary hosts (insectiverous bats) but on very rare occasions other animal hosts and human beings. In Europe, between 1977 and 2000, a total of 630 EBL cases in bats have been confirmed, mainly in Denmark, the Netherlands and Germany. There has been a previous bat-associated rabies case in the UK, when a Daubenton's bat... was found in Newhaven, Sussex during 1996. The animal was infected with EBL type virus. The virus had a genetic sequence which matched EBL viruses from the Swiss-German border, suggesting that this bat might have been a migrant bat... On rare occasions there has been transmission of EBLs to terrestrial mammals. On two occasions sheep have been infected and in 2002 EBL was detected in a stone martin in Germany. Since 1977 there have been three human deaths in Europe attributed to EBL infections, all in cases where the humans had been in close contact with bats. Although such human cases are very rare, the risk posed to humans from an EBL infected bat still exists... EBLs may only be transmitted by the bite of an infected bat. There is therefore no risk to human beings if bats are not approached or handled... Persons who find a sick or ailing bat should not approach or handle the bat but seek advice from a local bat conservation group. Persons licensed to handle bats... should ensure that they have rabies vaccination and should always wear protective gloves when handling bats. If any person is bitten by a bat, the wound should be...".** Just substitute "ABL" for "EBL" and, with a little customisation plus brief notes on Hendra and Menangle - there you are.

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